SUBSTITUTE SPECIFICATION

Method and device for drawing and mixing liquid samples

BACKGROUND OF THE INVENTION

(1) Field of the Invention

[0001] The present invention relates to the field of preparation of liquid samples with a view to their analysis.

[0002] The present invention relates more particularly to a method and a device for drawing and mixing liquid samples originating from at least n ($n \geq 2$) different containers.

(2) Prior Art

[0003] Such methods and/or devices for drawing and mixing liquid product samples are already known in the prior art.

[0004] In the United States document US H1960 H, a method and a device are proposed which are intended to analyse donations of blood or plasma with a view to detecting the specific donations having contamination by a virus, greater than a pre-established level. The method comprises a first step consisting of forming containers of unitary samples, sealed separately and interconnected, using a flexible hollow tubing segment connected to a container of donations of fluid. It is therefore a matter of drawing n times a given volume of a sample originating from a container. This step is repeated for n containers of donations of biological liquids. Advantageously, each container of samples is formed in order to contain approximately 0.02 to 0.5 ml of blood or plasma. A second step then consists of transferring identical volumes of a sample obtained in step 1 into a mixing

container. At this step, a sample from the n containers obtained is drawn.

[0005] Thus, according to one example embodiment of the invention described in US H1960 H, the drawing and mixing device comprises a central hollow tubular collection container connected to a vacuum source, and under which needles are connected for automatic drawing of blood or plasma from the unitary containers. Thus, once the needles are disposed to pierce through the unitary containers containing the blood or plasma samples, the vacuum is applied to the container so that the blood or plasma samples rise up through the needles into the container. Advantageously, in order to prevent any contamination, the drawing devices (needles for example) are sterilised or replaced so that cleaned or sterile devices are used between each mixture formed.

[0006] Also proposed in the United States patent US5364526 is a system making it possible to conduct, into a receiving or transfer container, biological fluid disposed in independent containers (at least two independent containers). This transfer takes place via a grouping device consisting of a plurality of pieces of tubing, said grouping device being in communication respectively with each of the independent containers and the receiving container. Advantageously, the elements constituting the system are disposed in a vertical arrangement, the independent containers being disposed above the receiving container. Once full, the receiving container is hermetically sealed and separated from the system, without air being introduced into said container. Advantageously, the system is a sterile system.

[0007] However, the method and system described in the aforementioned documents have drawbacks.

[0008] In particular, the method described by US H1960 H discloses a discontinuous method. It emerges in fact that, prior to the drawing of the samples, it is necessary to place pre-formed samples in an apparatus in order to allow the drawing of each of the pre-formed samples. The result is therefore a tedious and long method.

[0009] As regards the system described in US5364526, this, through its construction, offers no guarantee of drawing sterility. This is because the piece of tubing originating from each independent container is in contact with at least one other piece of tubing originating from another independent container. Such a system therefore does not allow drawings from containers to be isolated from one another.

SUMMARY OF THE INVENTION

[0010] The present invention intends to remedy the drawbacks of the prior art by proposing a method and a device allowing the continuous drawing and mixing of liquids originating from different original containers whilst avoiding the contamination of said original containers.

[0011] To do this, the object of the present invention is to propose a method for continuously drawing and mixing liquid samples originating from at least n ($n \geq 2$) different containers, characterised in that it comprises successively the steps consisting of:

[0012] - drawing a given volume of n samples originating from n different containers of liquids, each of the samples drawn being placed in a sampling chamber;

[0013] - transferring identical volumes of each sample drawn at the preceding step into a common mixing container in order to obtain a mixture sample to be analysed.

[0014] Advantageously, the drawing step consists of drawing a volume of liquid from each container comprising between 0.5 and 20 millilitres, and preferentially between 2 and 8 millilitres.

[0015] Advantageously, the step of transferring to the mixing container consists of transferring a volume of each drawn sample comprising between 0.5 and 20 millilitres, and preferentially between 2 and 8 millilitres.

[0016] Advantageously, the step of transferring the drawn samples into the mixing container is initiated by an external action.

[0017] Advantageously, the step of transferring the drawn samples into the mixing container is initiated automatically.

[0018] Advantageously, the drawing of the liquid samples of the first step is performed in a sterile manner.

[0019] Another aim of the present invention is to propose a continuous method for the analysis of biological liquids, characterised in that it comprises successively the steps consisting of:

[0020] - drawing a given volume of n samples originating from n ($n \geq 2$) different containers of liquids, each of the samples drawn being placed in a sampling chamber;

[0021] - transferring identical volumes of each sample drawn at the preceding step into a common mixing container in order to obtain a mixture sample to be analysed;

[0022] - transferring a given volume of the mixture sample to be analysed from the preceding step to an analysis device.

[0023] Advantageously, the step of transferring to the analysis device consists of transferring a minimum volume of 1 millilitre of the mixture sample.

[0024] Advantageously, the transfer at least in part of the mixture sample to the analysis device is performed aseptically.

[0025] The present invention also relates to a device for drawing and mixing samples of liquids originating from at least two different containers, said device comprising a mixing chamber connected to each of said containers, characterised in that said device comprises, between the container and the mixing chamber, at least one intermediate sampling chamber for each container, connected so as to transfer to said mixing chamber all or part of the sampled liquid, and in that said device is configured in a vertical arrangement.

[0026] Preferably, said mixing chamber is disposed under said sampling chambers.

[0027] Advantageously, the mixing chamber is associated in a removable manner with the sampling chambers.

[0028] Advantageously, the connection between the containers and the sampling chambers consists of a piece of tubing, a tap, a stopper that can be pierced by a needle or a screw-fitting sealed by a stopper.

[0029] Advantageously, the connection between the sampling chambers and the mixing chamber consists of a tube, a breakable fitting, a tap or a tubing clip.

[0030] Advantageously, the mixing chamber is sealed by means of a screwed stopper, a stopper that can be pierced by a needle, a tap or a piece of tubing.

[0031] Advantageously, said device comprises at least one non-return valve.

[0032] Advantageously, the drawing and mixing device is a sterile device.

[0033] Advantageously, the drawing and mixing device is a device that can be sterilised, preferably by β or γ irradiation.

[0034] Advantageously, said device comprises connection means for connecting said drawing and mixing device to an analysis device.

[0035] Advantageously, the connection between the drawing and mixing device and the analysis device is an aseptic connection.

[0036] Advantageously, the sampling chambers and/or the mixing chamber consist(s) of a flexible plastic material, of the PVC type.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] The invention will be better understood with the help of the description, given below purely by way of explanation, of one embodiment of the invention, with reference to the accompanying figures:

[0038] - Figure 1 illustrates a sectional view of a device for drawing and mixing samples of biological liquids according to a first embodiment of the invention; and

[0039] - Figure 2 illustrates a sectional view of a device for drawing and mixing samples of biological liquids according to a second embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0040] The invention concerns a method and a device for drawing and mixing samples of liquid products originating from different containers.

[0041] In the following examples, the samples of liquid products relate to samples of unstable blood products originating from bags. The objective of the device, in the examples described, is the continuous sterile preparation of samples of given volume, for the rapid detection of rare occurrences in said samples, such as the detection of bacteria or contaminating agents.

[0042] It is of course obvious that the application to unstable blood products is given here by way of an example and that the invention is in no way limited to this.

[0043] It is of course also obvious that the objective related to the detection of rare occurrences is also given by way of an example, in no way limiting the invention.

[0044] Figure 1 illustrates a first embodiment of said drawing and mixing device (1) of the invention.

[0045] Said device (1) consists, in this example embodiment, of three sampling chambers (2) aligned in a horizontal plane. A mixing chamber (3) is disposed under said sampling chambers.

[0046] Each of said sampling chambers (2) is connected via pieces of tubing (4) disposed on its upper part to separate bags of unstable blood products originating from different donors (not depicted), which are also equipped with pieces of tubing.

[0047] The connection between the drawing chambers (2) and the bags of blood will be implemented so as to allow sterile drawing.

[0048] Means, other than the pieces of tubing, may also be suitable for implementing the connection between the sampling chambers (2) and the bags of blood. They may be taps, plugs able to be pierced by a needle, or else a screw-fitting sealed by a stopper.

[0049] Each sampling chamber (2) is also equipped with a conveying tube (5), each of the tubes being intended to transfer, to said mixing chamber (3), all or part of the blood samples drawn from said bags of blood and contained in said sampling chambers (2).

[0050] Advantageously, the conveying tubes (5) consist of a breakable fitting to allow the blood sample contained in a sampling chamber (2) to flow to the mixing chamber (3).

[0051] The device according to the invention has the advantage of making it possible to eliminate any risk of contamination of said samples.

[0052] This is because the part of said device (1) intended for the drawing of said samples can advantageously be sterilised by β or γ irradiation, so that the risks of contamination of the samples by micro-organisms are eliminated.

[0053] Moreover, the envisaged connections make it possible to reduce as much as possible the risks of contamination of the samples by micro-organisms; the use in particular of tubing-to-tubing connection facilitates sterile connection. It concerns the case where the blood samples are drawn from bags of blood. It is then essential for the tubing to have an internal diameter of 3 millimetres and an external diameter of 4 millimetres.

[0054] In addition, the samples are drawn so that each sample cannot under any circumstances be contaminated by the samples from the other bags, so as to avoid sample-to-sample reactions for the parameters to be quantitatively analysed which are sensitive to their environment. In this case, the mixing will be performed at the time of the analysis to be performed on the mixed samples in order to reduce sample-to-sample contacts as much as possible.

[0055] Said device (1) also comprises connection means in order to be connected to an analysis device (not depicted) intended to detect in the mixture sample the presence of rare occurrences such as bacteria.

[0056] Advantageously, the connection is an aseptic connection.

[0057] In the example illustrated in Figure 1, the connection between the drawing and mixing device and the analysis device is implemented by means of tubing. It can also be implemented by means of a breakable fitting. In this case, prior to the connection of the mixing chamber to the analysis device, said mixing chamber is sealed by means of a stopper screwed onto said fitting.

[0058] Other means allowing the sealing of the mixing chamber but also the connection of said mixing chamber to said analysis device can of course be envisaged. In particular, such means can consist of a stopper that can be pierced by a needle or a tap.

[0059] Advantageously, the drawing and mixing device (1) is made from a material able to withstand γ or β irradiation and welding actions. Advantageously, said sampling chambers and/or the mixing chamber (1) consist(s) of a flexible material, preferably made of PVC.

[0060] Advantageously, the sampling chambers are formed from a single bag which is shaped by welding to have the desired number of sampling chambers (in this case in this example embodiment, three sampling chambers).

[0061] The method for drawing and mixing samples used with the device (1) of Figure 1 is presented below.

[0062] The first step consists of drawing in a sterile manner a given volume of three samples originating from three bags of blood originating from different donors. As explained previously, the drawing is performed so as to avoid the possibility of each bag drawn from being contaminated by the samples drawn from the other two bags. To do this, the drawing is advantageously implemented by means of a tubing-to-tubing connection. Each of said drawn samples is then respectively placed in the sampling chambers (2) which are independent of one another.

[0063] The drawing step consists of drawing from each of the bags preferentially a volume comprising between 2 millilitres and 8 millilitres. Furthermore, each bag of blood can be drawn from simultaneously or successively.

[0064] The following step consists of transferring an identical volume comprising preferentially between 2 millilitres and 8 millilitres of each drawn sample into said mixing chamber (3) in order to obtain the mixture sample to be analysed. This step of transferring all or part of the blood sample contained in the sampling chambers (2) to the mixing chamber (3) is initiated manually by a user. In fact the user carries out, through said mixing chamber consisting of a flexible material of the PVC type, an action to break the breakable fittings linking the sampling chambers (2) to the mixing chamber.

[0065] Once the fittings have been broken, the samples contained in the sampling chambers (2), which are disposed in a vertical arrangement, flow by gravity into the mixing chamber (3). Advantageously a pressure can be exerted on the sampling chambers (2) to accelerate the mixing.

[0066] The mixture sample thus obtained is transferred to said analysis device to be analysed, this analysis making it possible to determine whether or not said mixture sample comprises bacteria. The volume of mixture sample transferred to said detection device will be a minimum of 1 millilitre.

[0067] Advantageously, the transfer of the mixture sample to the analysis device is performed aseptically.

[0068] As seen in the example described previously, the drawing and mixing device (1) is constituted so that the mixing chamber (3) is associated with or can be directly fixed on the sampling chambers (2). It is of course obvious that said mixing chamber (3) can constitute an element separate from the sampling area formed by said sampling chambers (2) as illustrated in Figure 2.

[0069] The examples illustrated in Figures 1 and 2 describe the drawing of three blood samples. It is of course obvious that the device (1) according to the invention is configured to draw and mix n samples, n being an integer number greater than or equal to two.

[0070] According to a variant implementation of the invention, a reaction medium can be placed in the mixing chamber, within the context of preparing for the analysis of the mixture sample in the detection device to which said sample is going to be transferred.

[0071] Similarly, depending on the analysis provided for, a reaction medium can also be placed in each of the sampling chambers. This can be for example a medium allowing the growth of bacteria.

[0072] Moreover, the embodiments presented by way of example refer to samples of identical liquids. It should be understood that the samples originating from different bags can relate to different liquids.

[0073] The invention is described above by way of an example. It should be understood that persons skilled in the art are able to implement different variants of the invention without for all that departing from the scope of the patent.